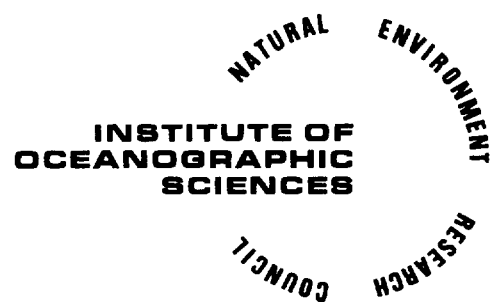


**GEOPHYSICAL DATA ACQUISITION
PROCESSING AND DISPLAY**

M.R. SAUNDERS, C.C. LEARY AND P.R. MILES

**REPORT NO. 109
1980**



INSTITUTE OF OCEANOGRAPHIC SCIENCES

**Wormley, Godalming,
Surrey, GU8 5UB.
(0428 - 79 - 4141)**

(Director: Dr. A.S. Laughton)

**Bidston Observatory,
Birkenhead,
Merseyside, L43 7RA.
(051 - 653 - 8633)**

(Assistant Director: Dr. D.E. Cartwright)

**Crossway,
Taunton,
Somerset, TA1 2DW.
(0823 - 86211)**

(Assistant Director: M.J. Tucker)

*On citing this report in a bibliography the reference should be followed by
the words UNPUBLISHED MANUSCRIPT.*

GEOPHYSICAL DATA ACQUISITION
PROCESSING AND DISPLAY

M.R. SAUNDERS, C.C. LEARY and P.R. MILES

REPORT NO. 109

1980

Institute of Oceanographic Sciences,
Brook Road,
Wormley, Godalming,
Surrey GU8 5UB

CONTENTS

1. AQUISITION OF GEOPHYSICAL DATA AT SEA	
(a) DISCOVERY IBM 1800	3
Conversion of CDAT disc file to mm tape file.	5
(i) Old System	
(ii) New System	
(b) IBM 1130/DATA LOGGER PORTABLE COMPUTER SYSTEM	6
(c) PDP 1134/DATA LOGGER REPLACEMENT COMPUTER SYSTEM	7
2. DISPLAY OF GEOPHYSICAL DATA	8
(a) LISTINGS	9
(b) PROFILES	9
(c) CHART PLOTS	9
(d) EXAMPLES	10
3. GEOPHYSICAL DATA REPORTS	19

ABSTRACT

The alternative methods of displaying geophysical data from the NERC computer are illustrated together with a summary of the various data acquisition systems in use.

1. AQUISITION OF GFOPHYSICAL DATA AT SFA

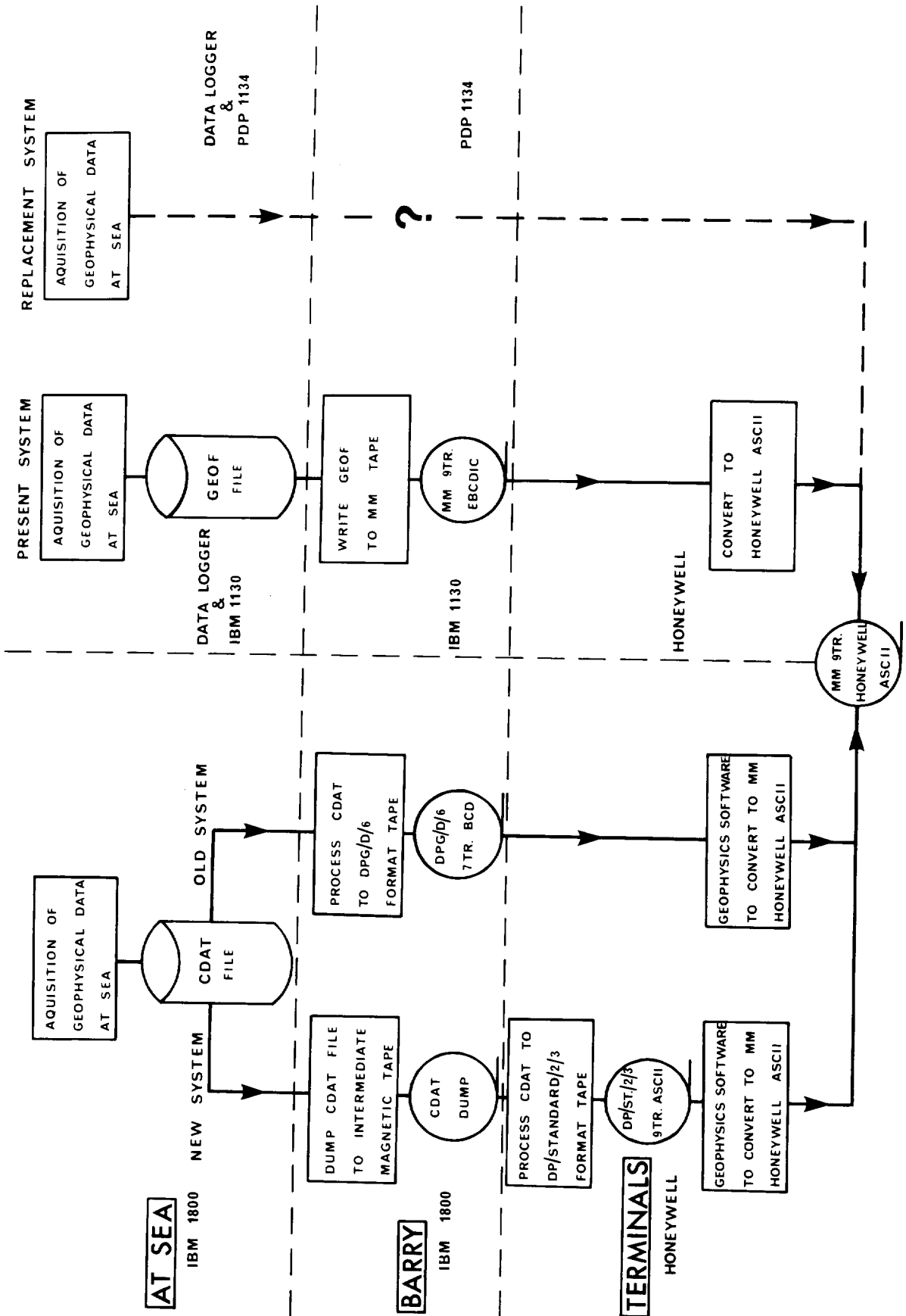
(a) DISCOVERY IBM 1800 SYSTEM

The IBM 1800 computer system installed onboard R.R.S Discovery samples the various data inputs and then manipulates the data to produce values at two minute intervals.

The relative values for ships speed, wind velocity and direction are calculated and written to the CDAT file together with the ships dead reckoning and observed data inputs. Positional information is monitored from navigational satellite passes, decoded and verified. If the satellite fixes are acceptable the dead reckoning values are updated, the observed data are processed to reduce the total magnetic and gravity readings to anomaly values by removing the respective reference fields. The ships course and speed and wind velocity are updated. Manually entered depths which are held in an input file are corrected for matthews area and written to the CDAT file together with the other corrected data.

Manual editing of the CDAT data involves the generation of plots, lists and profiles, using the MPX operating system, to systematically analyse and correct any errors. This is performed on a daily basis (Strudwick, 1976).

At the completion of a cruise all the corrected underway data is contained on CDAT disc files which are subsequently held at Barry.



CONVERSION OF CDAT FILE TO MM TAPE FILE

(i) OLD SYSTEM

The CDAT disc files are processed at Barry on the land based IBM 1800 computer to produce a file on magnetic tape, one per cruise leg, of CDAT data in DPG/D/6 format. This tape is 7 track BCD 556 bpi.

The magnetic tape is transferred to the Honeywell computer system at Bidston, where it can be accessed from terminals. Using Geophysics software the CDAT tape is processed to produce geophysical data on a 9 track Honeywell ASCII coded magnetic tape in merged merged international data exchange format.

(ii) NEW SYSTEM

The CDAT disc files are dumped without processing on to an 'intermediate' magnetic tape, one tape per cruise leg, using the IBM 1800 computer at Barry.

The tapes are transferred to the Honeywell computer system at Bidston where they can be accessed from terminals.

The tapes are processed using NCS developed software to produce a file in DP/STANDARD/2 version 3 format which is stored on 9 track 1600 bpi magnetic tape in non Honeywell ASCII coding. The format is designed so that it is suitable for any computer system handling formatted tape files.

The new tape is then, using Geophysics software, processed to produce geophysical data in merged merged international format on 9 track 800 bpi Honeywell ASCII coded magnetic tape.

Development is in progress to enable the production of the 'intermediate' tape to be carried out on the shipboard computer during the cruise.

(b) DATA LOGGER AND IBM 1130 PORTABLE COMPUTER SYSTEM

Cruise data is sampled and stored on magnetic tape by the data logger at one second intervals. Each logger tape lasts approximately fourteen hours then it can be removed to the 1130 system and data transferred to working files GEO..

Observed total magnetic and gravity readings are reduced to anomaly values by subtracting the reference field data.

The ships dead reckoning navigation is updated by manually entered satellite navigation fixes and written to GEOF. Depths, also entered manually, are corrected for matthews area by the input program and stored in GEOF together with navigation and anomaly values.

Editing of the GEOF data involves displaying profiles, lists and charts to identify and remove errors. Each GEOF disc file holds approximately five days data recorded at two minute intervals.

The GEOF files are written to 9 track EBCD coded magnetic tape in two forms; as a straight dump or converted into merged merged format.

On completion of the cruise the tapes are transferred directly to the Honeywell computer system at Bidston where they are accessible from terminals. The merged merged tape is converted and written to a 9 track Honeywell ASCII coded magnetic tape in the same merged merged international data exchange format as the tapes from the IBM 1800 system.

(c) PDP 1134 REPLACEMENT COMPUTER SYSTEM

As of writing, a PDP 1134 has been delivered to the Shipboard Computer Group at RVS Barry and is under software development tests. This system will replace the IBM 1130. Details of data handling and software were not available at time of writing but the data will be output as a magnetic tape in merged merged to be accessed through terminals of the Honeywell system.

2. DISPLAY OF GEOPHYSICAL DATA

Geophysical data is stored on 9 track tapes in merged merged international format coded in Honeywell ASCII. Tapes are accessed via terminals of the Honeywell system. The basic requirements for display of data is in the form of listings, profiles and chart plots.

DATA DISPLAY

PROGRAMS

LISTINGS	Direct merged merged listings of tape. 6 minute sampled listing in Data Report format.	LISDAT
PROFILES	Profiles of all underway data fields plotted against distance run. Single profile of underway data field plotted against run.	PROFPLOT
CHART PLOTS	Ships track. Data profile along track. Annotated data along track. Simplified track for whole cruise.	GEOPLOT

(a) LISTINGS

LISDAT provides programs to list geophysical data from a merged merged tape as either a direct continuous listing in mm format of 2 minute data or as a 6 minute sampled listing in Data Report format split into pages.

(b) PROFILES

PROFPLOT contains a set of programs to produce profiles of underway data plotted against distance run along track, which can be located on a mercator track chart of the same scale. Profiles can be plotted either individually or as multiple fields above each other on an A4 size page for presentation.

(c) CHART PLOTS

GEOPLOT contains a set of programs to read from a mm tape and plot the data at specified scale and map projection. The plotting routines are for ships track, ships track annotated with hour marks and satellite positions, data field values printed along the track and profiles of data along the track.

To plot the ships track for a whole cruise it is necessary to reduce the amount of data points to significant course changes, this is provided by program NAVSEL.

(d) EXAMPLES

The data used in these examples comes from Discovery Cruise 84 leg 1 Reykjanes ridge survey.

1. Merged merged data list.
2. Data Report list.
3. Profile of magnetic anomaly. Scale 1:2000000 at 57 degrees north. Mercator projection.
4. Multiple profiles of underway data. Scale 1:2000000 at 57 degrees north. Mercator projection.
5. Ships track with time marks and satellite fixes. Scale 1:2000000 at 57 degrees north. Mercator projection.
6. Magnetic anomaly values printed along track. Scale 1:2000000 at 57 degrees north. Mercator projection.
7. Magnetic anomaly profile along track. Scale 1:2000000 at 57 degrees north. Mercator projection.
8. Ships track from whole tape. Day number anotated at midnight. Scale 1:13000000 at 57 degrees north. Mercator projection.

(d1)

DISC84	77 627 12 0	61.0292-	28.1895 0	465.	859 7	50192-1803	64.
DISC84	77 627 12 2	61.0252-	28.1870 0	492.	910 7	50230-1764	63.
DISC84	77 627 12 4	61.0212-	28.1847 0	461.	852 7	50416-1577	63.
DISC84	77 627 12 6	61.0170-	28.1822 0	494.	914 7	50716-1276	63.
DISC84	77 627 12 8	61.0130-	28.1798 0	512.	947 7	51064 -927	62.
DISC84	77 627 1210	61.0090-	28.1773 0	520.	961 7	51346 -644	62.
DISC84	77 627 1212	61.0048-	28.1748 0	536.	991 7	51574 -415	62.
DISC84	77 627 1214	61.0008-	28.1723 0	492.	910 7	51722 -266	61.
DISC84	77 627 1216	60.9968-	28.1700 9	486.	899 7	51808 -178	61.
DISC84	77 627 1218	60.9927-	28.1675 0	522.	965 7	51882 -103	61.
DISC84	77 627 1220	60.9885-	28.1650 0	526.	972 7	51984 0	60.
DISC84	77 627 1222	60.9843-	28.1623 0	501.	927 7	52110 126	60.
DISC84	77 627 1224	60.9802-	28.1598 0	508.	940 7	52278 295	60.
DISC84	77 627 1226	60.9760-	28.1573 0	468.	865 7	52528 546	60.
DISC84	77 627 1228	60.9717-	28.1547 0	496.	918 7	52746	59.
DISC84	77 627 1230	60.9675-	28.1522 0	538.	994 7	52748	59.
DISC84	77 627 1232	60.9633-	28.1497 0	535.	989 7	52656 678	59.
DISC84	77 627 1234	60.9592-	28.1472 0	509.	941 7	52610 633	58.
DISC84	77 627 1236	60.9550-	28.1445 0	520.	961 7	52580 604	58.
DISC84	77 627 1238	60.9508-	28.1420 0	526.	972 7	52528 553	58.
DISC84	77 627 1240	60.9467-	28.1393 0	532.	983 7	52534 560	58.
DISC84	77 627 1242	60.9425-	28.1367 0	502.	929 7	52624 651	59.
DISC84	77 627 1244	60.9383-	28.1342 0	500.	925 7	52726 754	59.
DISC84	77 627 1246	60.9342-	28.1315 0	550.	1016 7	52758 787	59.
DISC84	77 627 1248	60.9300-	28.1288 0	537.	993 7	52732 762	59.
DISC84	77 627 1250	60.9257-	28.1263 0	510.	943 7	52744 775	60.
DISC84	77 627 1252	60.9215-	28.1235 0	472.	872 7	52786 819	61.
DISC84	77 627 1254	60.9173-	28.1210 0	416.	769 7	52956 990	62.
DISC84	77 627 1256	60.9130-	28.1183 9	484.	896 7	53364 1399	63.
DISC84	77 627 1258	60.9088-	28.1157 0	438.	810 7	53802 1838	63.
DISC84	77 627 13 0	60.9048-	28.1127 0	384.	709 7	54320 2357	64.
DISC84	77 627 13 2	60.9007-	28.1097 0	405.	749 7	54846 2884	64.
DISC84	77 627 13 4	60.8967-	28.1067 0	495.	916 7	54768 2807	63.
DISC84	77 627 13 6	60.8925-	28.1038 0	502.	929 7	54502 2542	63.
DISC84	77 627 13 8	60.8885-	28.1008 0	462.	854 7	54398 2439	62.
DISC84	77 627 1310	60.8843-	28.0978 0	498.	921 7	54324 2366	62.
DISC84	77 627 1312	60.8803-	28.0948 0	525.	971 7	54198 2242	62.
DISC84	77 627 1314	60.8763-	28.0920 0	469.	866 7	54046 2091	62.
DISC84	77 627 1316	60.8723-	28.0892 0	478.	885 7	53902	63.
DISC84	77 627 1318	60.8683-	28.0863 9	457.	844 7	53960 2007	63.
DISC84	77 627 1320	60.8642-	28.0833 0	486.	899 7	54134 2182	63.
DISC84	77 627 1322	60.8598-	28.0805 0	464.	857 7	54174 2223	63.
DISC84	77 627 1324	60.8557-	28.0775 0	526.	972 7	54038 2088	63.
DISC84	77 627 1326	60.8515-	28.0747 0	540.	998 7	53664 1715	63.
DISC84	77 627 1328	60.8472-	28.0717 0	480.	888 7	53226 1279	64.
DISC84	77 627 1330	60.8430-	28.0687 0	488.	903 7	52880 934	64.
DISC84	77 627 1332	60.8388-	28.0658 0	497.	919 7	52608 663	64.

*

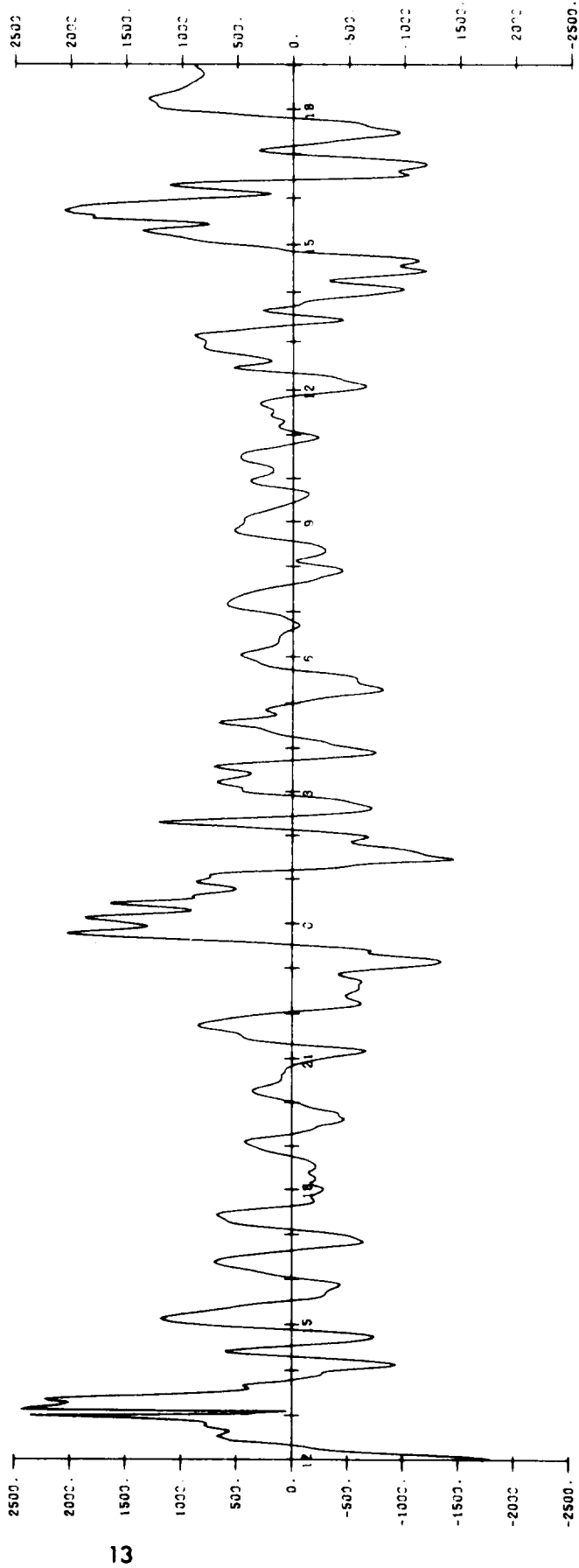
(d2)

CRUISE IDENT	DATE	HR MIN	LAT	LONG	UCTD FATHOMS	CTD METRES	MATT AREA	TOTAL MAGFIELD	MAG ANOM	FAA
DISC84	77 627	12 0	61.0292	-28.1895	465	859	7	50192	-1803	64
DISC84	77 627	12 6	61.0170	-28.1822	494	914	7	50716	-1276	63
DISC84	77 627	1212	61.0048	-28.1748	536	991	7	51574	-415	62
DISC84	77 627	1218	60.9927	-28.1675	522	965	7	51882	-103	61
DISC84	77 627	1224	60.9802	-28.1598	508	940	7	52278	295	60
DISC84	77 627	1230	60.9675	-28.1522	538	994	7	52748		59
DISC84	77 627	1236	60.9550	-28.1445	520	961	7	52580	604	58
DISC84	77 627	1242	60.9425	-28.1367	502	929	7	52624	651	59
DISC84	77 627	1248	60.9300	-28.1288	537	993	7	52732	762	59
DISC84	77 627	1254	60.9173	-28.1210	416	769	7	52956	990	62
DISC84	77 627	13 0	60.9048	-28.1127	384	709	7	54320	2357	64
DISC84	77 627	13 6	60.8925	-28.1038	502	929	7	54502	2542	63
DISC84	77 627	1312	60.8803	-28.0948	525	971	7	54198	2242	62
DISC84	77 627	1318	60.8683	-28.0863	457	844	7	53960	2007	63
DISC84	77 627	1324	60.8557	-28.0775	526	972	7	54038	2088	63
DISC84	77 627	1330	60.8430	-28.0687	488	903	7	52880	934	64
DISC84	77 627	1336	60.8303	-28.0598	498	921	7	52318	375	64
DISC84	77 627	1342	60.8177	-28.0510	525	971	7	52352	412	64
DISC84	77 627	1348	60.8048	-28.0422	530	980	7	51932	-3	63
DISC84	77 627	1354	60.7920	-28.0332	502	929	7	51680	-252	63
DISC84	77 627	14 0	60.7790	-28.0243	546	1009	7	51592	-336	62
DISC84	77 627	14 6	60.7662	-28.0157	529	978	7	51044	-881	60
DISC84	77 627	1412	60.7535	-28.0070	504	932	7	51124	-797	58
DISC84	77 627	1418	60.7407	-27.9982	560	1036	7	51838	-81	54
DISC84	77 627	1424	60.7278	-27.9895	626	1157	7	52508	592	49
DISC84	77 627	1430	60.7150	-27.9808	680	1258	7	52186	273	45
DISC84	77 627	1436	60.7022	-27.9723	700	1296	7	51596	-312	42
DISC84	77 627	1442	60.6895	-27.9637	704	1303	7	51202	-703	40
DISC84	77 627	1448	60.6765	-27.9565	700	1296	7	51260	-642	39
DISC84	77 627	1454	60.6633	-27.9492	759	1404	7	51962	62	37
DISC84	77 627	15 0	60.6505	-27.9420	800	1481	7	52706	810	34
DISC84	77 627	15 6	60.6377	-27.9350	852	1578	7	53048	1155	33
DISC84	77 627	1512	60.6245	-27.9288	871	1613	7	52982	1092	
DISC84	77 627	1518	60.6110	-27.9212	775	1435	7	52650	764	34
DISC84	77 627	1524	60.5980	-27.9138	874	1618	7	52368	485	34
DISC84	77 627	1530	60.5850	-27.9058	780	1444	7	52010	130	36
DISC84	77 627	1536	60.5717	-27.8978	788	1459	7	51620	-255	
DISC84	77 627	1542	60.5585	-27.8898	840	1556	7	51562	-310	38
DISC84	77 627	1548	60.5457	-27.8820	766	1419	7	51488	-381	40
DISC84	77 627	1554	60.5330	-27.8743	782	1448	7	51434	-431	42
DISC84	77 627	16 0	60.5202	-27.8665	759	1404	7	51708	-154	42
DISC84	77 627	16 6	60.5073	-27.8587	767	1420	7	52034	174	41
DISC84	77 627	1612	60.4945	-27.8510	812	1503	7	52226	370	41
DISC84	77 627	1618	60.4815	-27.8432	797	1475	7	52464	611	43
DISC84	77 627	1624	60.4687	-27.8353	763	1413	7	52544	694	
DISC84	77 627	1630	60.4558	-27.8270	792	1466	7	52354	508	46
DISC84	77 627	1636	60.4437	-27.8177				51986	143	48
DISC84	77 627	1642	60.4313	-27.8085	865	1602	7	51596	-243	49
DISC84	77 627	1648	60.4193	-27.7997	743	1375	7	51222	-613	52

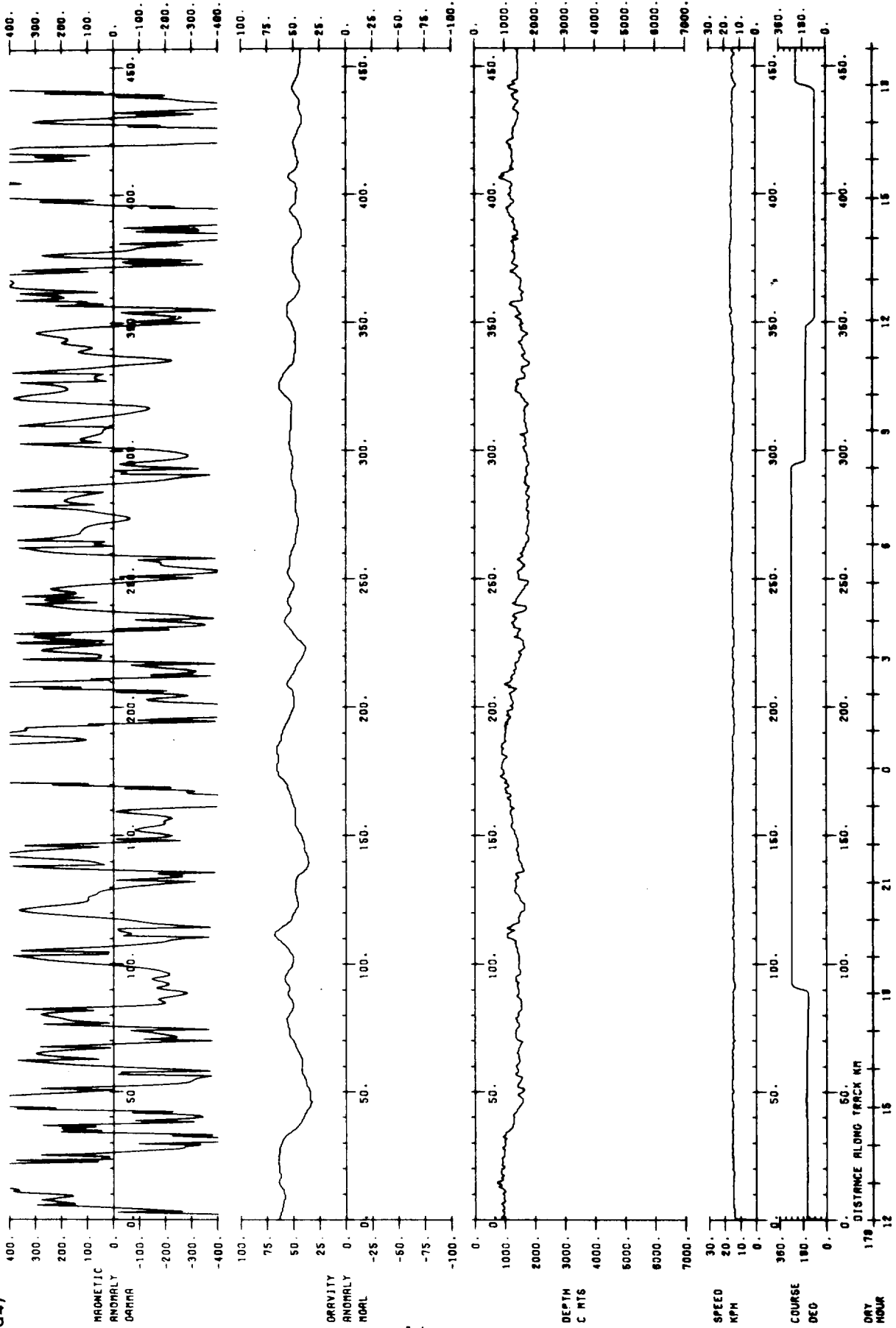
(d3)

MAGNETIC ANOMALY IN GAMMAS ALONG TRACK

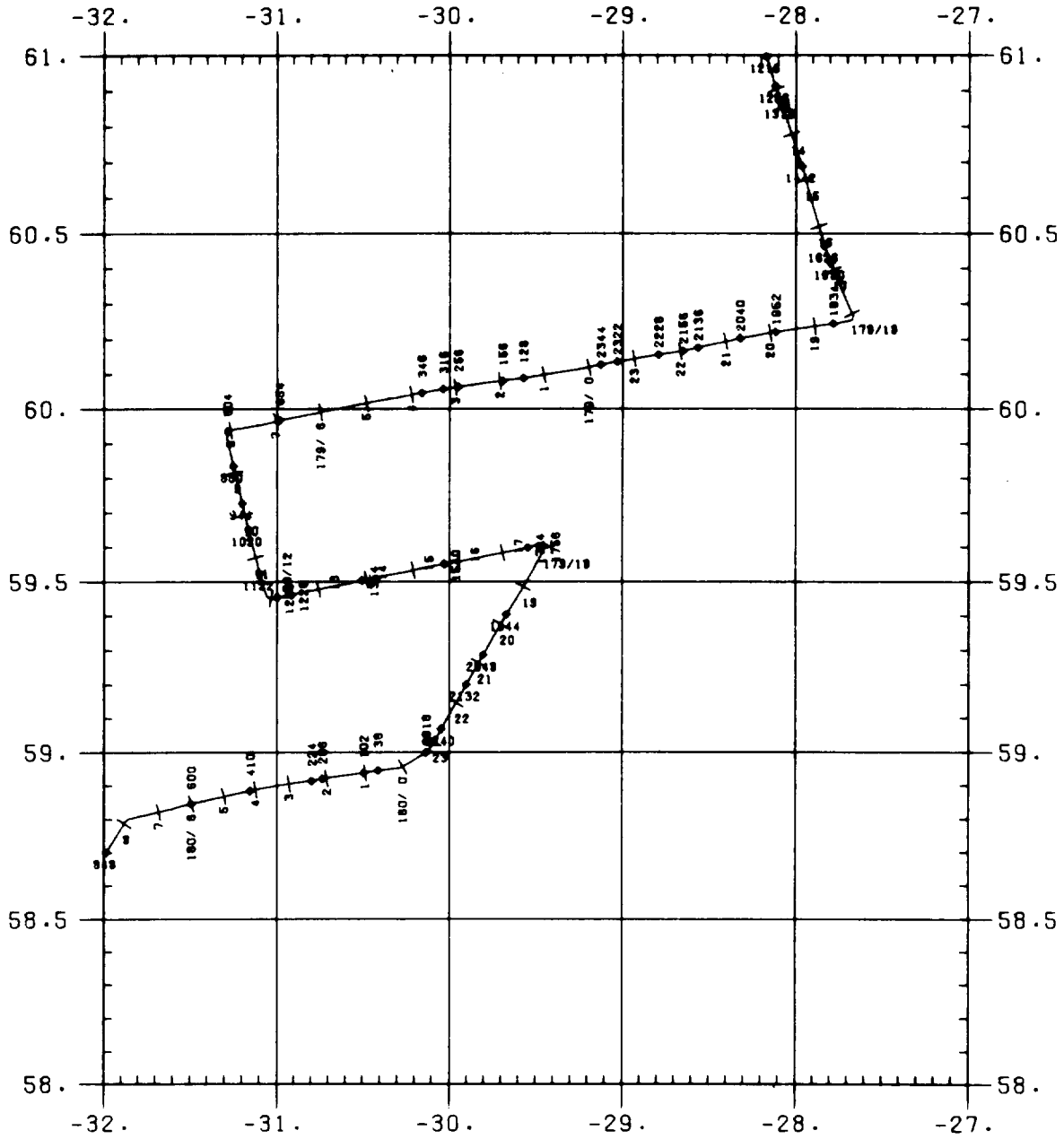
START 1200 DAY 178 SCALE 2000000



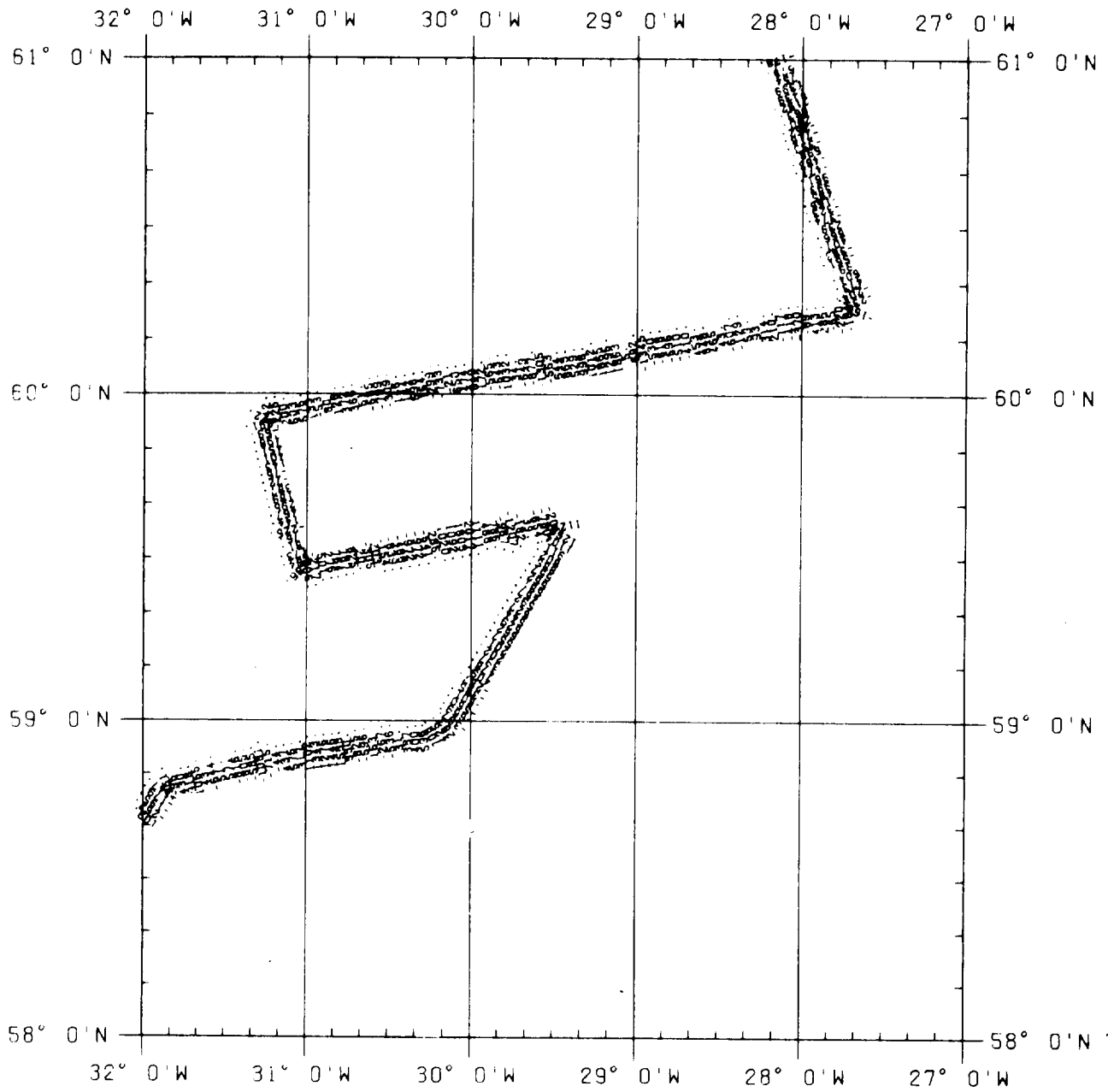
(d4)



(d5)

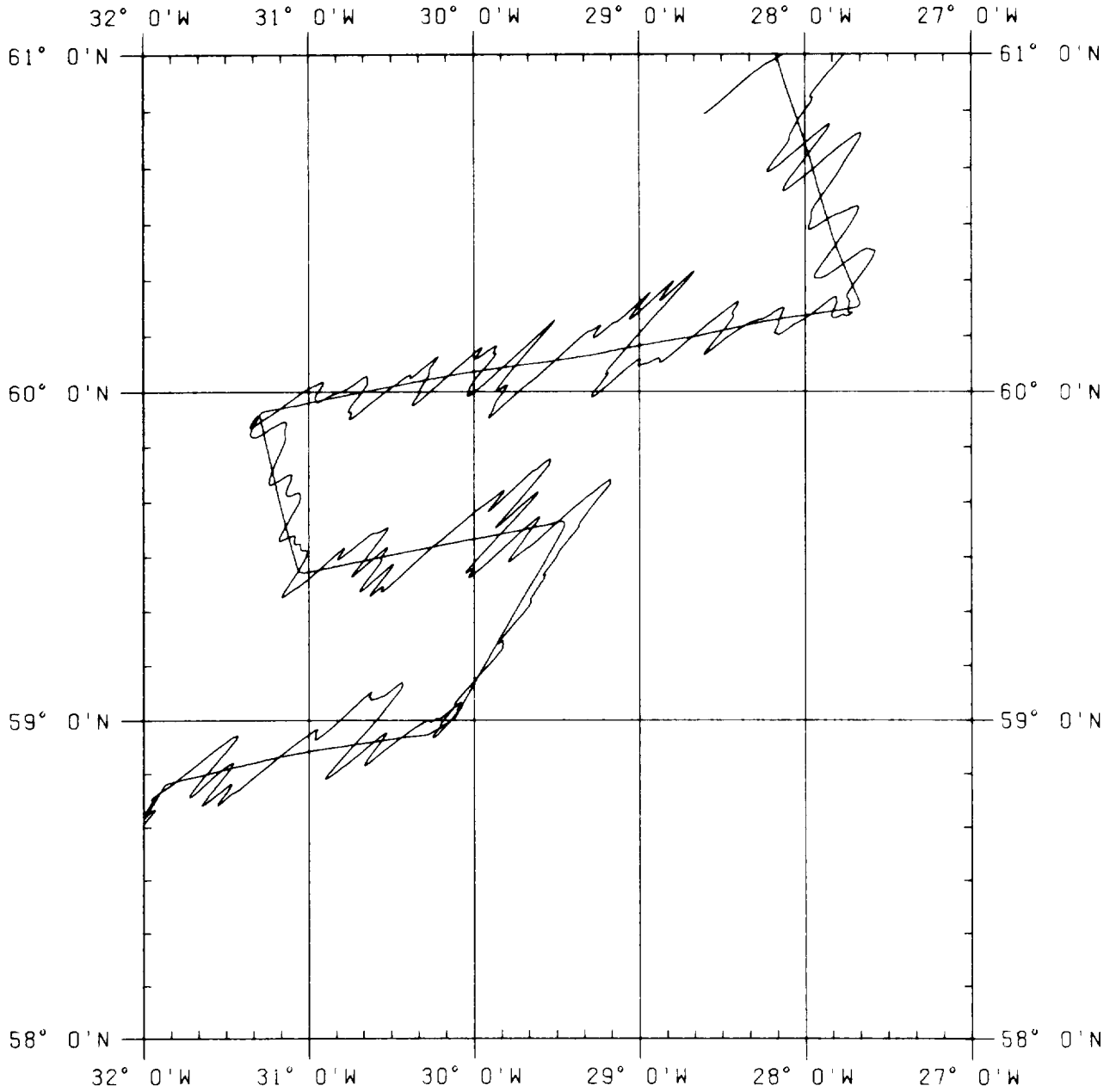


(d6)



40-VALUE OF RESIDM AGAINST TRACK

(d7)



— SHIP'S TRACK
— RESIDM PROFILED AGAINST TRACK

3. GEOPHYSICAL DATA REPORTS

These reports document navigation, magnetic, bathymetric and gravity data collected during I.O.S cruises. The profiles, tables and track charts are all generated from merged merged data tapes using the routines previously mentioned.

PROFILE LOCATION SHEET

The ships track is plotted on an outline bathymetric chart at a scale of 1:2400000, this is used for locating data profiles. The day numbers are annotated at midnight positions. The profile positions are numbered.

DATA PROFILES

Profiles of magnetic anomaly, corrected depth, free air anomaly, course-made-good and speed-made-good are plotted against distance run along the ships track from the start of a leg. The distance is scaled to 1:240000 and adjusted for mercator projection enabling the profiles to be overlain on the location sheet. A time axis in GMT is included to enable correlation with data listings, which are recorded against time not distance.

Reduced copies of the original P.E.S./S.R.P. records are mounted opposite the appropriate profile to provide more detail.

NAVIGATION

Navigation track charts are plotted at a scale of 1:1000000 at the standard latitude in 4 degree areas. Hour marks are annotated with hour and day number every six hours. The position of acceptable satellite fixes are annotated with time.

DATA LISTINGS

Data from the mm tape is listed at 6 minute intervals in report format with additional Julian day numbers.

REFERENCES

ANONYMOUS 1975 Standard format MPX-SHIP Discovery data files on non-MPX systems. Institute of Oceanographic Sciences Data Processing Development Group Internal Report DPG/D/6 Version 1. (Unpublished manuscript).

STRUDWICK, W. K. 1976 The editing of underway data acquired aboard the R.R.S. 'Discovery'. Institute of Oceanographic Sciences Report No.22 14pp & figs (Unpublished manuscript).

STRUDWICK, W. K. & LEARY, C.C. 1980 Discovery Data. Institute of Oceanographic Sciences Data Processing Internal Report DP/STANDARD/2 Version 3. (Unpublished manuscript).